Electronic Parts Engineering Section 507

Laboratory Facilities Instruction

(JPL D-15854)

Prepared by: _____ Date: 6/24/98

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Reviewed and
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PROCESS: Electronic Parts Engineering (Section 507) Laboratory Facilities Operation and Maintenance

SCOPE: **This document records the nominal processes required to operate and maintain laboratory facilities for the Electronic Parts Engineering Office (Section 507).**

APPLICABILITY: **The procedures recorded in this document apply to users of the laboratory facilities listed in the following table.**

Laboratory Facility	Location	Cognizant Engineer	Phone
Failure Analysis (FA)	300-110	Sid Johnson	x4-2298
Scanning Electron Microscope (SEM)	300-108	Ken Evans	x4-4834
Parts Evaluation (PE)	300-127	Mike O'Connor	x4-5595

FACILITY MANAGEMENT: **The group supervisor in charge of the listed facilities is Dr. Charles E. Barnes, M/S 303-200, Ph#: x4-4467.**

DOCUMENT CHANGE LOG

Issue	Date	Approval	Affected Pages
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Section I.

REGULARLY SCHEDULED FACILITY MAINTENANCE PROCEDURES - A time based hierarchy of operational procedures for the facilities is explained in this section. The relevant facility process is shown in *bold-italicized* font and further elaboration of the procedures can be found in Section II of this document.

1. Daily Procedures:

1. Restoring Facility Operations From Shutdown

    1. ***Safety*** Checks - Do not enter the facility if the following conditions exist:
        a. Alarm (flashing red lights and horn) for oxygen monitor is tripped.
        b. An obvious safety hazard exists (e.g., posted warning)

    2. ***Equipment*** Maintenance - Perform procedures required to maintain the operability of laboratory equipment.

2. Facility Shutdown - To be performed at the end of the work day.

    1. ***Safety*** Checks - The last employee leaving the facility must perform a walk-through check of the facility to ensure that all equipment and utilities are secured for a safe overnight shutdown. Facility doors are required to be locked during the overnight shutdown period.

    2. ***Storage*** Procedures - The facility staff are responsible for ensuring that ongoing tasks are properly stored during the shutdown period. Special handling (e.g., emergency notification) procedures for tests in progress that require equipment to operate during the overnight period shall be indicated on a posted sign.

2. Weekly Procedures:

1. ***File*** Backups - Make back-up copies at the end of the week of electronic files that support facility operations. This procedure is generally conducted at the end of the work week.

2. ***Safety*** - Maintain a resonably clean and safe working environment by clearing away unecessary clutter and and disposing of debris. This procedure is generally conducted at the end of the work week.

3. ***Utilities*** - Facility users are responsible for consulting "JPL This Week" for any utility interruptions that will impact ongoing work. This procedure is generally conducted at the end of the work week.

3. Monthly Procedures: - None.

4. Annual Procedures:

1. ***Safety*** - Note: Scheduling of the various audits is at the discretion of the inspecting agency.

    1. JPL Safety Operations Section (SOS) Audit

    2. Audits by Other Agencies (e.g., OSHA)

    3. Staff Training and Certification - JPL required staff training/certification to be performed as deemed necessary by the cognizant training organization.

2. ***Equipment***

    1. Property Inventory - Annual property inventory scheduled by JPL.

    2. Capital Equipment Plan -A capital equipment plan prepared in accordance with JPL guidelines for the acquisition of new/upgraded equipment. This procedure is performed on a schedule determined by Section 507 in cooperation with the funding agency(ies).

3. Maintenance Contracts - Renewal of annual maintenance contracts for equipment that is to be serviced by vendors outside of JPL. This procedure is performed on a schedule determined by the affected service contracts.

5. Performed As-Needed Procedures:

1. Ordering ***Supplies*** - Staff members are responsible for ordering and maintaining an adequate stock of consumables.

2. Calibration of ***Equipment*** - Equipment calibration is to be performed as required to support tasks performed in the facilities.

3. ***Storage*** of toxic/hazardous wastes - The handling and disposal of toxic/hazardous wastes shall be in accordance with all applicable regulatory guidelines as communicated to the staff by JPL's System Safety Office.

4. Plant Maintenance/Repair Notification - The staff shall notify JPL Plant Maintenance in the event of conditions that require their attention.

5. Updates to Documentation - Self explanatory.

Section II.

GENERAL FACILITY PROCESSES - The following table describes the processes used to operate and maintain the facilities.

PROCESS	*Process Component*	*Component Description*	*Cognizant*
EQUIPMENT	Equipment List	A list of functional equipment with general operating procedures is maintained under the cognizance of the Radiation Test and Failure Analysis Group supervisor. The list identifies the primary operator and location of equipment in the facilities. Revisions to the equipment list are made at the discretion of the cognizant group supervisor. The current list is attached to this document as Appendix I.	C. Barnes
	Equipment Maintenance and Calibration	Regularly scheduled equipment maintenance and calibration is performed in accordance with the manufacturer's recommendations. Additional requirements for testing / examination / analysis of flight equipment are at the discretion of the requesting project.	Primary Equipment Operators
	Capital Equipment Plan	Equipment purchase plans are prepared in accordance with JPL guidelines.	C. Barnes
FILE	Equipment Manuals and Calibration Certificates	Equipment operation manuals, service manuals and calibration certificates are maintained in the facility files unless noted otherwise in the Current Equipment List.	Primary Equipment Operators
	Specifications and Standards	Reference copies of regularly utilized specifications and standards referenced and/or required in tasks supported by the facilities are maintained in the facility files or are accessible electronically via on-line resources. Controlled copies are available from JPL documentation via on-line resources.	C. Barnes

PROCESS	***Process Component***	***Component Description***	***Cognizant***
FILE (cont'd)	Work Order and Task Log Book(s)	A database(s) that enables the documentation of tasks submitted to the facility is maintained. The database(s) includes the ability to track labor charges and other costs associated with specific tasks. Backup copies of essential files are to be made on a weekly basis.	Facility Users
	SEM micrograph negatives	The SEM facility provides archival storage of micrograph negatives.	K. Evans
	Material Safety Data Sheets (MSDS)	All facilities containing controlled / hazardous materials maintain a binder containing the applicable MSDSs.	Safety Coordinator
SAFETY	Cleaning and General Housekeeping	Users of the facility have the responsibility to maintain a reasonably clean and safe work environment.	Facility Users
	Facility Alarms and Emergency Announcements	The facility must be vacated when the low oxygen alarm or fire alarm sound. Facility users must comply with official JPL instructions announced via the paging system in response to emergencies.	Facility Users
	Training and Certification	The applicability of training requirements and records of such training and/or certification are the responsibility of the section safety coordinator. Record of such inspections are maintained by the cognizant inspecting agency.	Safety Coordinator
	Facility Access	Access to the facilities is not controlled. All unescorted visitors to the facility are expected to obey all posted warnings.	Safety Coordinator

PROCESS	***Process Component***	***Component Description***	***Cognizant***
SAFETY (cont'd)	Required Inspections	Inspections of laboratory resources to ensure safe operations (e.g., fume hoods, radiation sources/shielding, oxygen monitors, fire extinguishers, etc.) are performed in accordance with applicable JPL and/or government regulations on a schedule determined by the inspecting agencies. Records of such inspections are maintained by the cognizant inspecting agency.	Safety Coordinator
	End of Shift Inspection	Perform facility walk-around inspection to ensure all equipment is secured and that a safe condition exists for facility shut-down.	Facility Users
STAFF	Radiation Test and Failure Analysis Group	A database of personnel assigned to operate and maintain the facility. The database includes emergency notification provisions (e.g., ph. #, pager, e-mail, etc.) and the facility hierarchy for contingency operations.	Section Office
STORAGE	Work In-Progress	Storage shelves and file cabinets and work benches for securing work in-progress are provided in the facility. Applicable signs are posted to alert other users of the facility to any special handling precautions.	Facility Users
	Equipment	Storage shelves and work benches are utilized to store moveable equipment used in the execution of tasks within the facility.	Facility Users and Primary Equipment Operators
	Chemical and Material	Appropriate storage receptacles/facilities are provided for chemical and material supplies and waste materials in conformance with requirements communicated by the Safety Operations Section.	Safety Coordinator
SUPPLIES	Laboratory Supplies and Consumables	The JPL supply and procurement processes is utilized to maintain adequate provisions for operation of the facility. The scheduled replenishment of facility supplies is at the discretion of the staff and is performed as required.	Facility Users

PROCESS	***Process Component***	***Component Description***	***Cognizant***
UTILITIES	Interruptions and Contingencies	Check "JPL This Week" for utility interruptions. Notify affected users and formulate contingencies.	Facility Staff and Safety Coordinator
	Location of Circuit Breakers and Shut-off Valves	Facility users trained to recognize the location and operation of utility shut-down panels and valves.	Safety Coordinator

Appendix I.

Section 507 Lab Equipment Roster and Operating Procedures

Equipment, Location and *Primary Operator*	**Model**	**Used For…**	**Notes**	**Operating Procedure and Document Location**
Scanning Electron Microscope (SEM) Location: 300-108C *Primary Operator: Ken Evans*	Hitachi S-4000	High Resolution imaging of surfaces and elemental analysis	Magnification up to 300,000X and 15 Angstrom resolution. Low KV image capability. Ability to detect elemental composition and distribution in sample for M/Z>boron.	Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manual is co-located with the equipment.
Scanning Electron Microscope (SEM) Location: 300-108D *Primary Operator: Ken Evans*	Cambridge S-250	High Resolution imaging of surfaces and elemental analysis	Magnification up to 100,000X. Ability to detect elemental composition and distribution in sample for M/Z>boron.	Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manual is co-located with the equipment.
Scanning Electron Microscope (SEM) Location: 300-108B *Primary Operator: Ken Evans*	Amray 1830i	High Resolution imaging of surfaces and elemental analysis	Magnification up to 50,000X. Ability to detect elemental composition and distribution in sample for M/Z>boron.	Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manual is co-located with the equipment.
Plasma Coater and Etcher Location: 300-108 *Primary Operator: Ken Evans*	Anatech Hummer 10.2	SEM sample preparation	Sputter coat conductive layer (Au, Au-Pd) on samples. Etch samples using Argon	Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manual is in the SEM facility files.
Vacuum Carbon/Metal Evaporator Location: 300-108B *Primary Operator: Ken Evans*	Denton Benchtop Turbo	SEM sample preparation	Evaporate carbonb or metal conductive layers on samples	Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manual is in the SEM facility files.
Infrared Video Camera System Location: 300-108E *Primary Operator: Ronald Ruiz*	Inframetrics PM-300	Infrared mapping of samples	Microscopic and Macroscopic capabilities	Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manual is located with the primary operator.
Optical Microscopes Location: 300-110C *Primary Operator: Sid Johnson*	Olympus AH-30, Leitz	High Resolution visual surface analysis	AHT-B3 with DIC Normarski, Dark Field with video image and polaroid capability. Maximum magnification up to 1500X.	Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manual is in the FA facility files.
Filar microscope measurement system Location: 300-110C *Primary Operator: Sid Johnson*	N/A	Applying surface measurements to samples	Used in conjuction with optical microscopes. Measure samples at .1 mil resolution	Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manual

Equipment, Location and *Primary Operator*	**Model**	**Used For…**	**Notes**	**Operating Procedure and Document Location**
				is in the FA facility files.
Wirebond Pull Test System Location: 300-110C *Primary Operator: Jim Okuno*	Unitek MP-4	Measure pull strengths of internal wires in electronic parts.	Measures destructive and non-destructive wirebond pull strengths from 0.1 grams to 1 kg force	Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manual is in the FA facility files.
Macrophot Camera Location: 300-110C *Primary Operator: Sid Johnson*	Nikon	Visual inspection of samples	Macro-photographic capabilities with polaroids	Consult the primary operator prior to first use for specific instructions.
Laser Trace Cutting System Location: 300-110C *Primary Operator: Duc Vu*	Alessi REL-4100A	Marking targets for inspection and testing. Used in isolating circuits on ICs.	YAG Laser on Microprobe station. ~1 um dia. Spot minimum	Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manual is in the FA facility files.
Computer Imaging System Location: 300-110C *Primary Operator: Russell Lawton*	PGT Imagist / Sun Sparc5	Digital image acquisition and metrology.	Has interface to acquire SEM images from Hitachi S-4000.	Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manual is in the FA facility files.
Temperature Humidity Chamber Location: 300-110 *Primary Operator: Sid Johnson*	Blue M B-2730-Q	Environmental testing (e.g. 85/85)		Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manual is in the FA facility files.
Computer Driven Stage Probe station Location: 300-110 *Primary Operator: Sid Johnson*	Wentworth PR0201RH	Electrical probing of microcircuits		Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manual is in the FA facility files.
Test vector generator Location: 300-110 *Primary Operator: Duc Vu*	Step Engineering		This equipment is portable within the facility.	Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manual is in the FA facility files.
Thermal Ovens Location: 300-110 *Primary Operator: Sid Johnson*	Delta Design 6400	Thermal Bake-out	High (+200^{o} C) Low (-65^{o} C)	Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manual is in the FA facility files.
Vacuum Bakeout Ovens Location: 300-110 *Primary Operator: Sid Johnson*	VWR 1410D, Thelco Precision Model 19	Thermal vacuum bakeout of components	Uses mechanical vacuum pump.	Consult the primary operator prior to first use for specific instructions.
Pull Tester Location: 300-110C	Unitek	Pull testing of electronic components	Pull test samples up to 5 kg.	Consult the primary operator prior to first use for specific instructions.

Equipment, Location and *Primary Operator*	**Model**	**Used For…**	**Notes**	**Operating Procedure and Document Location**
Primary Operator: Jim Okuno		and assemblies.		
Emission Microscope for Multi-Layer Inspection (EMMI) Location: 300-112 *Primary Operator: Duc Vu*	EMMI KLA	Detects photon emissions from dielectric breakdown in ICs		Consult the primary operator prior to first use for specific instructions.
ESD Tester Location: 300-112 *Primary Operator: Duc Vu*	IMCS 5000	Electro-Static Discharge testing in ICs		Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manual is in the FA facility files.
Cabinet X-ray Machine Location: 300-110D *Primary Operator: Jim Okuno*	Astrophysics Corp. TORREX 150D	Internal structure analysis of sample	Up to 150 KV X-rays	Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manual is in the FA facility files.
Particle Impact Noise Detection (PIND) test system Location: 300-110D *Primary Operator: Jim Okuno*	BW-LPD-B2000/2010	Performing PIND tests per Mil-STD requirements	28 gram max. DUT mass	Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manual is in the FA facility files.
Die/Ball Bond Shear Test System Location: 300-110D *Primary Operator: Jim Okuno*	Bondtest30	Performing Die Shear and Ball Bond shear testing per Mil-STDs.	Up to 5 kg shear force	Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manual is in the FA facility files.
Liquid Crystal IC Hot Spot Detection System Location: 300-110 *Primary Operator: Robert Gauldin*	N/A (Test Method)	Detecting hot spots on failed/defective ICs.		Consult the primary operator prior to first use for specific instructions.
Parallel Plate Plasma Etcher Location: 300-110E *Primary Operator: Jim Okuno*	Technics	Removing silicon nitride passivation layers from ICs.	Anisotropic Etcher	Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manual is in the FA facility files.
Helium Pressure Vessels Location: 300-110E *Primary Operator: Jim Okuno*		Pressurizing components for hermeticity testing	Up to 150 PSIg	Consult the primary operator prior to first use for specific instructions. Written instructions are located in the FA facility files.
Fine Leak Test System Location: 300-110E *Primary Operator: Jim Okuno*	Varian Auto-test 947	Performing fine leak hermeticity testing	Sensitivity up to 1E-9 Atm cc/sec He.	Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manual

Equipment, Location and *Primary Operator*	**Model**	**Used For…**	**Notes**	**Operating Procedure and Document Location**
				is in the FA facility files.
Bubble Gross Leak Tester Location: 300-110E *Primary Operator: Jim Okuno*	Trio-Tech 481	Performing bubble gross leak testing per Mil-Std.		Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manual is in the FA facility files.
Small Machine shop Location: 300-110F *Primary Operator: Sid Johnson*		In house fabrication for test fixturing and device decapsulation and machining.		Consult the primary operator prior to first use for specific instructions.
Potting and semi-automatic cross sectioning and polishing equipment Location: 300-110A *Primary Operator: Robert Gauldin*	Struers Rotopol-2 & Rotopol-V	Performing semi-automatic fine cross sectioning of potted samples for examination.	Equipment capable of sectioning 6 samples simultaneously.	Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manual is in the FA facility files.
Diamond wet grinding wheels Location: 300-110A Location: 300-110F *Primary Operator: Robert Gauldin*	Leco VP-50	Grinding extremely hard materials such as ceramics		Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manual is in the FA facility files.
High-speed diamond Saw Location: 300-110B *Primary Operator: Robert Gauldin*	Struers Accutom-2	Cutting hard ceramic and/or metallic samples.		Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manual is in the FA facility files.
Chemical Hoods (3 ea) Location: 300-110B Location: 300-108 *Primary Operator: Sid Johnson*		General purpose use	Organic and Non-Organic material Hoods	Consult the primary operator prior to first use for specific instructions.
High temperature Thermal Oven Location: 300-110B *Primary Operator: Sid Johnson*	Delta 6400	High temperature testing	High (+400^{o} C) Contains Test Lead Ports.	Consult the primary operator prior to first use for specific instructions.
Jet-etch acid plastic part decapsulation system Location: 300-110B *Michael O'Connor*	NSC PA103	Decapsulating plastic packaged parts without damaging the device		Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manual is in the FA facility files.
High precision analytical digital scales Location: 300-108 Location: 300-110B *Primary Operator: Ronald Ruiz*			Resolution to 0.1mg	Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manual is in the SEM facility files.
Digital Sine Vibration Controller	DSC-1	Vibration and Shock	Range: 5 to 6250 Hz	Consult the primary operator prior to first

Equipment, Location and *Primary Operator*	**Model**	**Used For…**	**Notes**	**Operating Procedure and Document Location**
Location: 300-110D *Primary Operator: Duc Vu*		Testing	Stability: +/- 100 ppm/C	use for specific instructions. The manufacturer supplied instruction manual is in the FA facility files.
Temperature Cycler Location: 300-110F *Primary Operator: Duc Vu*	Temptronic	Rapid Temperature cycling of DUTs	-55 to +125^{o} C	Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manual is in the FA facility files.
Actel Field Programmable Gate Array (FPGA) programmer Location: 300-112 *Primary Operator: Duc Vu*	Actel	Programming of Actel FPGAs		Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manuals are co-located with the equipment.
MBT-250A Enhanced Soldering Station Location: 300-127 *Primary Operator: Mike O'Connor*	PACE MBT-250A	Soldering and De-soldering of electronic components.	Has special tips and fixtures for handling quad flat-packs, thru-holes with precise temperature control.	Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manuals are co-located with the equipment.
Circuit Board Milling Machine Location: 300-127A *Primary Operator: Mike O'Connor*	LPKF Promat 93S	CAD/CAM system for the creation of copper traced circuit boards.	Uses a computer controlled milling machine to pattern copper traces on fiberglass circuit boards.	Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manuals are co-located with the equipment.
Temperature Shock Oven Location: 300-127A *Primary Operator: Mike O'Connor*	Delta 9080	Performing temperature shock tests on components.	The oven has a shuttle that transfers between a hot and cold oven.	Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manuals are co-located with the equipment.
Thermal Ovens w/ Power Supplies for Burn-In Location: 300-127A *Primary Operator: Mike O'Connor*	Delta	For burn-in qualification of electronic components.	Ovens and power supplies rack mounted.	Consult the primary operator prior to first use for specific instructions. The manufacturer supplied instruction manuals are co-located with the equipment.

Equipment, Location and *Primary Operator*	**Model**	**Used For…**	**Notes**	**Operating Procedure and Document Location**
Sheet Metal Equipment Location: 300-127A *Primary Operator: Mike O'Connor*	Various	Sheet metal fabrications.		Consult the primary operator prior to first use for specific instructions.
Personal Computer Equipment Locations: 300-108, 300-110, 300-127 *Primary Operator: Facility Staff*	Various	Various	General purpose computers and associated peripherals.	Consult the facility staff prior to first use for specific instructions.